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Abstract

SEPARATION AND PURIFICATION OF CERTAIN RADIOISOTOPES FOR MEDICAL USE

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This paper deals with newly investigated procedures for the separation and purification of certain radioisotopes for medical applications. The methods described are recommended for producing S^{35}, Ca^{45}, Sc^{46}, Sc^{48}, Ag^{111} and Au^{199} in carrier-free state, Cr^{51} of increasing specific activity, and carbon-coated preparations of mixed Au^{198} and Ag^{111} radioisotopes, as well as carbon suspensions with inactive gold impregnated with Ag^{111}. All radionuclides separated have a radiochemical purity exceeding 99%.

A simple method is developed for separating carrier-free S^{35} ($T_{\frac{1}{2}}$ = 87d) from neutron irradiated KCl free from any contaminating P^{32} activity. The behaviour of both S^{35} and P^{32} activities on the strongly basic anion exchanger, Dowex-1, has been studied and the optimum conditions for their separation are used. On the other hand, both carrier-free Ca^{45} ($T_{\frac{1}{2}}$ = 153d) and Sc^{46} ($T_{\frac{1}{2}}$ = 84d) are separated from pile-irradiated alkali fluorotitanates. In such a case, the behaviour of both radionuclides on the strongly acidic cation exchanger, Dowex-50, in differing hydrochloric acid concentrations has been investigated and the two radioisotopes fractionally separated. Both products are free from any titanium traces. Further, carrier-free Sc^{48} ($T_{\frac{1}{2}}$ = 44h) is prepared from neutron irradiated vanadium targets by solvent extraction/ion exchange techniques.

The methods described for the production of both carrier-free Ag^{111} and Au^{199} activities are based on co-crystallization technique. Ag^{111} ($T_{\frac{1}{2}}$ = 7.6d) is separated in saline solution or by further electrodeposition on Pt-electrode from pile-irradiated palladium targets. Carrier-free Au^{199} ($T_{\frac{1}{2}}$ = 3.15d), on the other hand, is separated from neutron irradiated platinum.

Moreover, Cr^{51} of increased specific activity is separated from neutron irradiated K_2CrO_4 targets (Szilard-Chalmers reaction) by two successive purification steps on the strongly basic anionite, Dowex-1.

Finally, carbon-coated preparations with mixed Au^{198} ($T_{\frac{1}{2}}$ = 2.7d) and Ag^{111} radioisotopes as well as suspensions with Ag^{111} on inactive gold-on-carbon are produced. In both cases, carrier-free Ag^{111} is readily deposited on carbon particles previously coated with gold. The latter suspension is preliminarily formed by mixing Au^{198} and/or gold solution with carbon particles followed by reduction with ascorbic acid, respectively. Both preparations possess outstanding stability resisting desorption and are not sedimented before 30 minutes duration.